Space Weather Technical Forecast

Issued on Wednesday 5 March 2025 at 01:17 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: chance of M-class flares (R1-R2; Minor-Moderate radio blackouts) throughout. G1/G2 Day 1 and Day 4.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity measured at GOES16 and 18 has been Low, with a peak flare of C4.6 at 04/1545UTC from AR4012 located in the southeast quadrant. The solar disc features eight sunspot regions. Most notably being AR4012 which is the largest and most complex. The second most notable region is AR4006, in the southwest quadrant, has declined in the past 24 hours with a fading of the intermediate spots

No Earth-directed Coronal Mass Ejections (CMEs) were identified in available coronagraph imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE at L!, have changed little in the past 24 hours following the weekend High Speed Stream (HSS) enhancement related to CH19/+ and remain at mostly Slightly Elevated levels between 430 and 550 km/s. Solar wind density was mainly below average, less than 5pppc. The Interplanetary Magnetic Field was at mostly Weak levels and the north-south component was rather variable and Weak until around 04/1900UTC when a period of southward directed component was observed and probably related to the anticipated glancing blow Coronal Mass Ejection (CME). The 24 hour period range was from +7/-8nT. The phi angle was largely positive (away from the Sun), with brief incursions to negative (towards the sun).

The net result of the above solar wind measures was Quiet (Kp0-2) geomagnetic activity, becoming Unsettled to minor storm level (Kp3-5) to end the day.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at Background.

High energy electron flux saw a rise in its diurnal oscillation, reaching High levels of 1130pfu at 03/1830UTC. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), on a mostly level if slightly declining trend, recording 4.43e7 integrated pfu at 04/2100TC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate levels expected, with a Chance of isolated M-class flares.

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Solar Wind / Geomagnetic Activity: The CME that departed the sun on 01/1730UTC from the southeast quadrant is probably now affecting Earth as a glancing blow and impacts will likely continue into Day 1 (5 March). This is the only CME in the forecast.

Slightly Elevated winds may become Elevated at times on Day 1 otherwise expected to continue declining towards Background over coming days. On Day 4 (8 March) the next fast wind related to a coronal hole (CH21/-) may reach Earth with elevated to strong levels.

Geomagnetic activity mostly at Quiet to Unsettled (Kp1-3) levels through the period but on Day 1 (5 March) and probably again on Day 4 (8 March) Active to G1/minor geomagnetic storm (Kp3-5) levels may reach G2/Moderate geomagentic storm (Kp6) levels

Energetic Particles / Solar Radiation: High energy proton flux should remain at Background levels.

High energy electron flux has seen diurnal rises into the high levels in the past 24 hours, with a declining trend now expected. The associated 24 hour fluence is expected to remain below the Active threshold.

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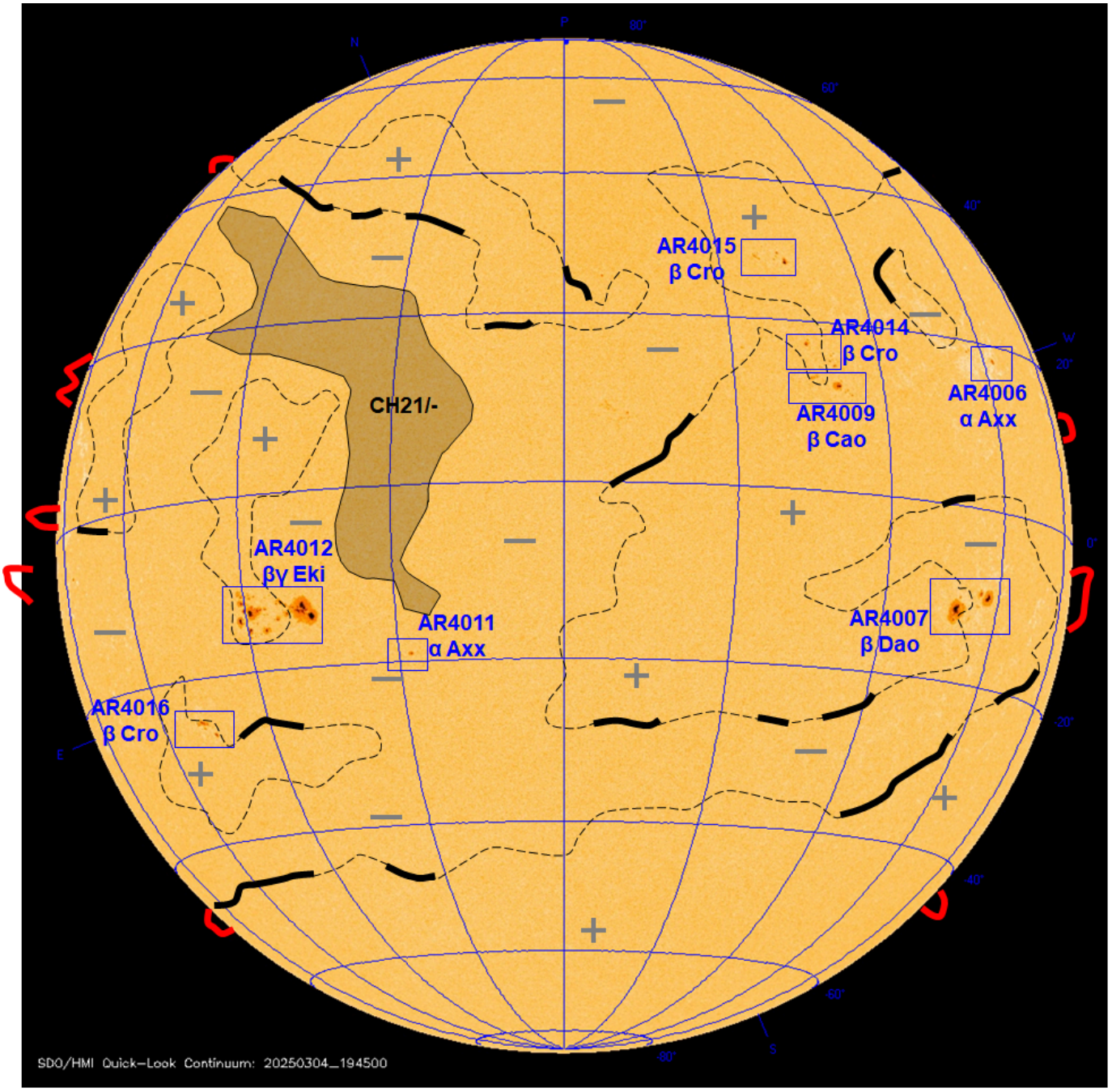
Figure 1: Solar Synoptic Map - 04/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

The CME that departed the sun on 01/1730UTC from the filament eruption from the southeast quadrant is probably now affecting Earth as a glancing blow and impacts will likely continue into Day 1 (5 March). This is the only CME in the forecast. The majority of the ejecta is most likely south and east of the Sun-Earth line, and much of the ejecta is likely to miss Earth.

In addition to the above, the High Speed Stream (HSS) influence from previous CH enhancements is expected to continue to generally wane, however Slightly Elevated winds may become Elevated at times on Day 1, otherwise expected to continue declining towards Background over coming days. On Day 4 (8 March) the next fast wind related to a coronal hole (CH21/-) may reach Earth with elevated to strong levels.

Geomagnetic activity mostly at Quiet to Unsettled (Kp1-3) levels through the period but on Day 1 (5 March) and probably again on Day 4 (8 March) Active to G1/minor geomagnetic storm (Kp3-5) levels may reach G2/Moderate geomagentic storm (Kp6) levels, on both days given the nature of the filament eruption and also the nature of the Coronal Hole in 4 days time, although admitttedly on the last rotation in February G1 ((Kp5) was the highest level attained.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	5	1	30
Strong	G3	No	1	1	1	0
Severe	G4	No	1	1	1	0
Extreme	G5	No	1	1	1	0

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
02/0154UTC	Partial?	Filament eruption	SE quadrant	550	Late UTC day Tuesday 04 March, around 04/1900UTC.	Potentially protracted but marginal effects on passage given glancing incidence.

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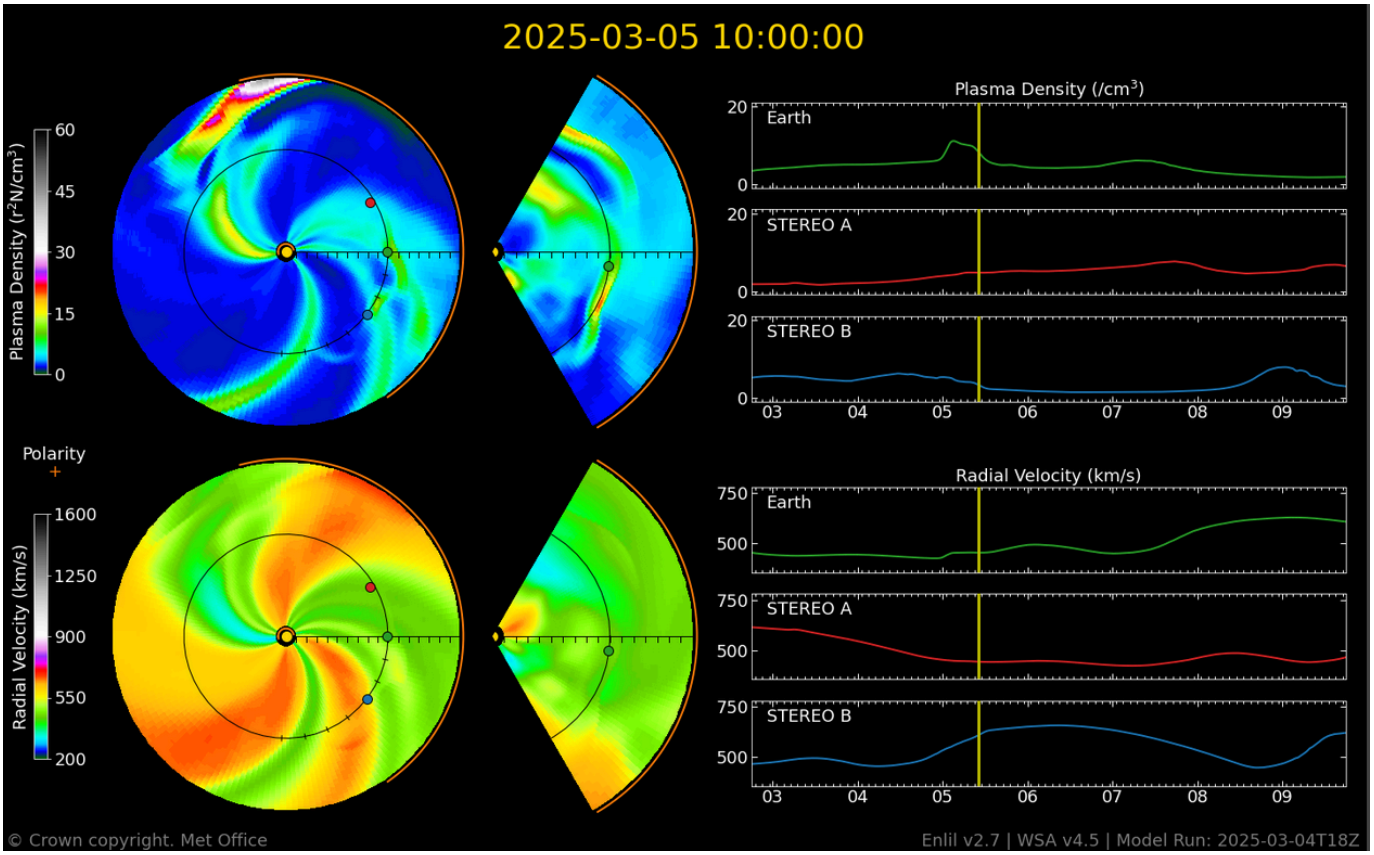
Figure 2: MOSWOC ENLIL showing CME in vicinity of Earth on Day 1 (5 March).



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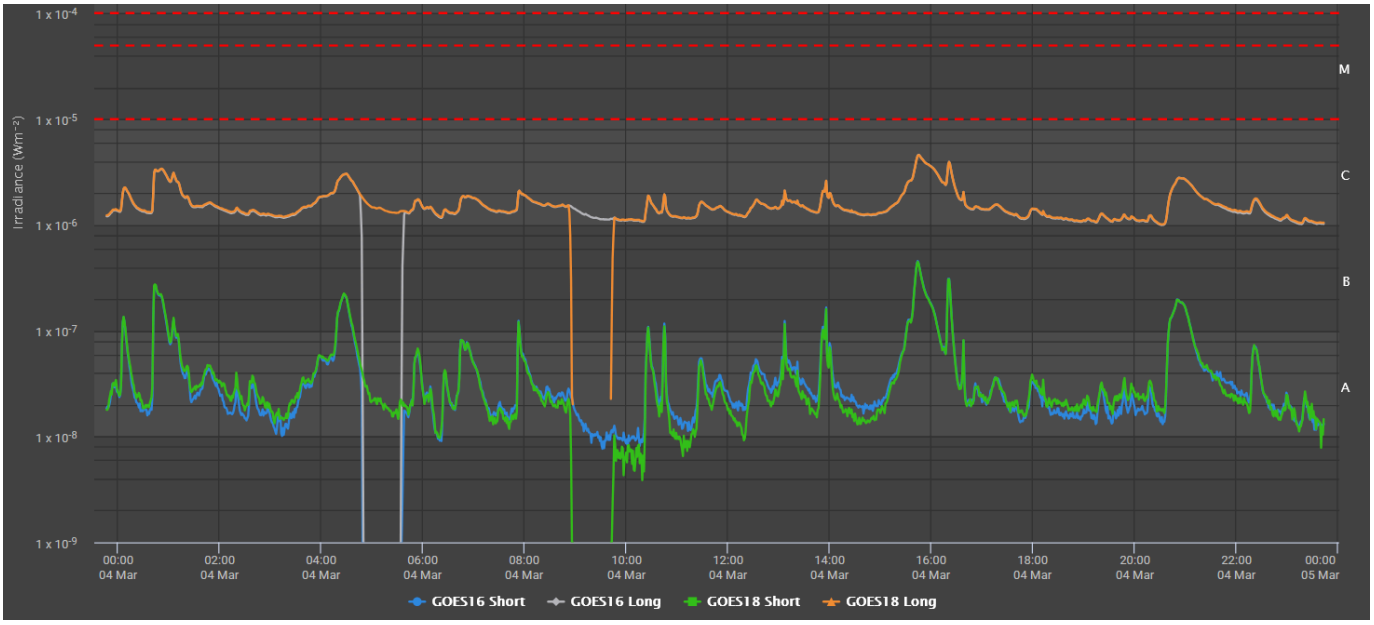
Radio Blackouts - X-Ray Flares

Eight sunspot regions cover the visible solar disc. AR4012 iin the southeast s the largest region and shows slow growth. AR4007, the second largest region , is a relatively simple bi-polar group. AR4009 lies just south of AR4014 and both regions remain bi-polar with little change in recent hours. AR4006 and AR4011 present as small and simple spots on the disc. A newly numbered region AR4016 in the southeast continues to slowly grow with some development of the traling spot.

Solar activity is Low, with occasional low level C-class flares. Solar activity carries a Chance of M-class flares with the main risk from AR4012 in the southeast and this may bring solar actvity up to Moderate levels.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	50	50	50	50
Very Active	R3-R5 (X Class)	No	1	1	1	1

Figure 3: GOES16/18 X-ray flares, with sveral low level C-class flares.



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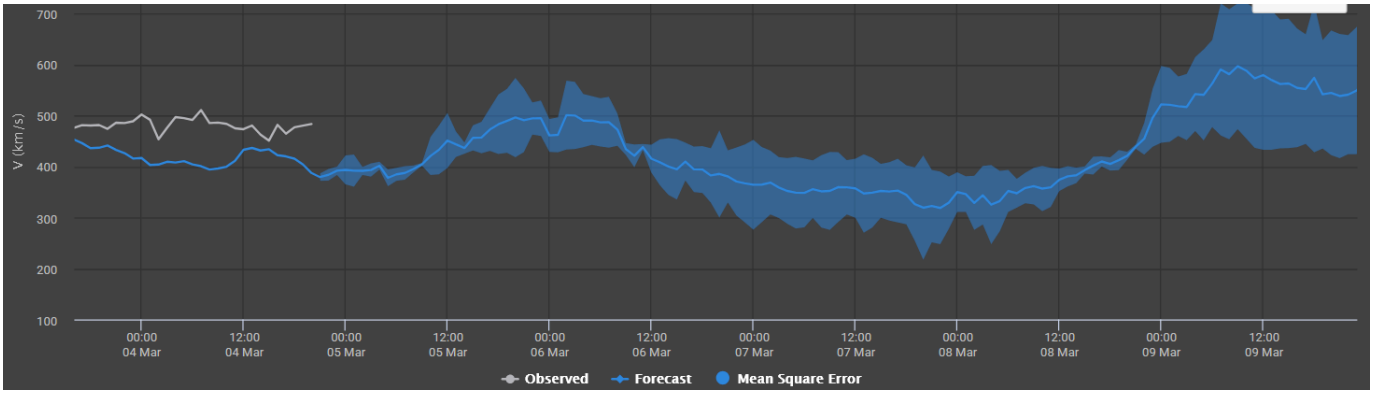
Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux is at Background, and expected to remain at this level. There is a Slight Chance of enhancement to S1 given any significant eruption from the sunspot regions currently on the Earth-facing disc, very gradually increasing towards the weekend period as AR4012 progresses further west to reach a more favourable part of the visible solar disc (i.e. the westernmost third).

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office Solar Winds Prediction Model (SWPM), showing next HSS arriving on Day 4 (8 March).



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High Energy Electrons (≥ 2MeV)

The high-energy electron flux (>2MeV), as observed at GOES16, has been mostly Moderate but saw a very brief spell of High flux in the past UTC day. This was due to the recent charging of the outer Van Allen Belt from the fast wind enhancement from CH18/+ and/or CH19/+. Moderate flux being maintained at GEO becomes less certain through the period as a result of possible influence of the 01/1730UTC filament CME, which may cause electron redistribution and falls of flux at GEO, which appears to be underway in recent observations of high-energy electron flux. No further enhancements are forecast.

The associated 24-hour fluence will probably now decline and is likely to remain below Active as indicated by MOSWOC REFM guidance output.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	1

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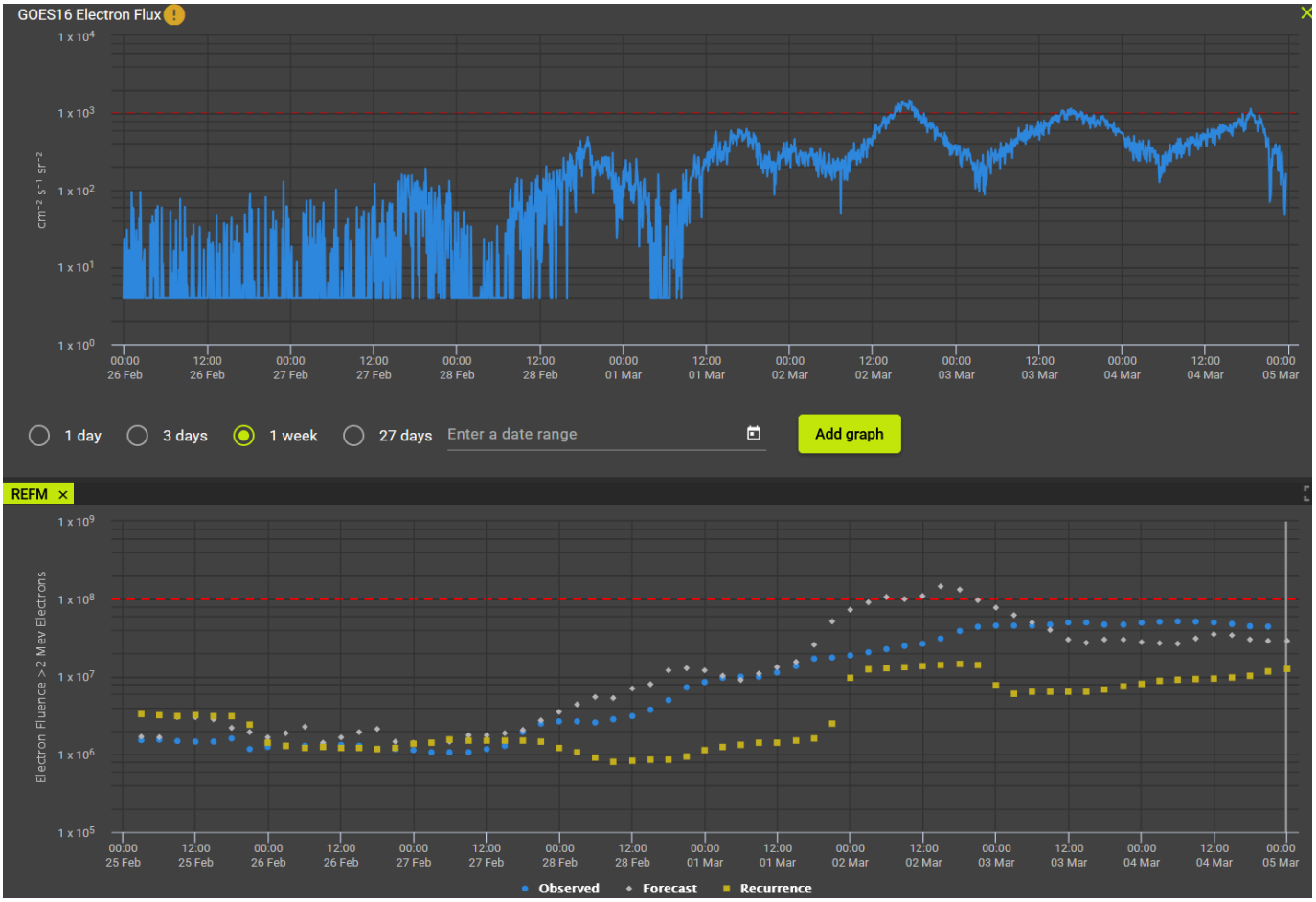
Figure 5: REFM Electron fluence and GOES16 Electron Flux.



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